



Faculty of Economic and Management Sciences

Fakulteit Ekonomiese en Bestuurswetenskappe
Lefapha la Disaense tša Ekonomi le Taolo

Study guide

Department of Economics

EKN825 Economics of Energy and the Environment

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1. Course overview and objectives

Saving our planet, lifting people out of poverty, advancing economic growth...these are one and the same fight. We must connect the dots between climate change, water scarcity, energy shortages, global health, food security and women's empowerment. Solutions to one problem must be solutions to all.

Ban Ki-moon

Climate change represents the greatest and widest-ranging market failure ever seen.

Nicholas Stern

There is no doubt in my mind that the literature on climate change overwhelmingly supports the hypothesis that climate change is caused by humans. I have very little reason to doubt that the consensus is indeed correct.

Richard Tol

Looking at the above quotes, one can be convinced that energy, environmental and climate change issues are highly linked with social sciences and particularly the field of economics. Energy being one of the main inputs to production, by some considered the fifth factor of economic production cannot be underestimated in economic decisions by both the private but also the public domains. At the same time, energy is a necessity good for the population and access to it an important determinant to development and reduction of poverty.

Like any other sub-field of economics, energy and environmental economics are concerned with the basic economic issue of scarcity and optimal allocation of limited resources in the economy. Micro- and macro- economic topics of energy supply and demand as well as investment financing and linkages with the rest of the economic system form an essential part of the broader picture. Since the 1980s, environmental concerns of energy use and its effects on the climate and economic development dominated the debate and research directions. In the last two decades, the discussions were enriched with the impact of energy market linearization and restructuring, high-energy (particularly oil) prices, energy scarcity, alternative forms of energy generation and energy poverty. The underlying factor in all these is the advancement of technologies that allow the science to move forward.

The main purpose of this module is to introduce and expose students to topics of the economics of energy and the environment, including the supply and demand dynamics topped with the characteristics of the energy markets; linkages with the economy and the well-being of the population; the Energy and Green Paradoxes; policies, approaches and technologies to improve the current conditions; climate change: its measurement, impact and valuation, as well as the energy and environmental conditions and issues in the broader African continent and South Africa specifically.

The goals are to provide the students with a set of tools to approach basic questions in energy and environmental economics, to be able to argue crisply and logically about these issues from an economic point of view, and to think outside the box as future economist.

2. Administrative information

2.1 Contact details



Prof. Roula Inglesi-Lotz

Department of Economics

Email: roula.inglesi-lotz@up.ac.za

Tel: 012 420 4504

Office: Tukkiewerf 1-13

Consulting hours: By appointment **only**.

2.2 Timetable

Classes are scheduled for every Thursday at 9 am for 3 hours at Tukkiewerf 1-37. Any changes will be announced in clickUP, by email or in class.

2.3 General communication

The primary means of communication of important information is your email; therefore you are requested to make sure that the lecturer has the correct email address. This type of information will be requested through a survey as well in the first lecture. ClickUP will be our main platform for interactions, assignments, discussions and grading. A whatsapp group may also be created for faster communication, if agreed at the first lecture.

3. Study material

All required readings are available through ClickUP. The papers are also available through the respective journal platforms in the UP library website. The amount of reading required weekly vary by topic, week and type of material. At this level, you are expected to use your own judgement on the time devoted. If, for example, a report is 150 pages long, you may just skim it to get the main ideas. But if it is a nontechnical, 5-page

paper, read it thoroughly¹. Some of the readings include technical and detailed analysis. In general, the students are advised to go through and understand these parts but not necessarily being able to reproduce them by heart.

In short, students should come prepared to discuss the essence of the reading materials and be able to participate in class debates. Also by reading all this material, students will be more informed with writing their essays.

Appreciating the continuously evolving nature of energy and environmental issues, this list of suggested material will inevitably change. Any changes will be announced in clickUP at least a week before the respective week in class.

4. Assessment

4.1 Educational approach

The module's educational approach adopts a number of elements and principles from the "University of Pretoria's Teaching and Learning Principles" as follows:

| T&L Principle | Approaches and tools |
|---|---|
| Encouraging contact between students and lecturers | <ul style="list-style-type: none">▪ Face-to-face classes;▪ Discussion forum among the students and lecturer after every lecture;▪ Text messaging course reminders and activities (possibly a "whatsapp" group to share info faster) |
| Inviting engagement | <ul style="list-style-type: none">▪ Suggested guided readings to create awareness and opportunities to students to comprehend basic concepts and principles before class;▪ Role-play exercise towards the end of the semester to demonstrate their knowledge of the material and learn how to present their opinion and argue constructively |
| Building connections | <ul style="list-style-type: none">▪ Authentic data sourcing and analysis;▪ Real-life South African examples and case studies to connect the principles taught with applications;▪ Role-play exercise in a real-life environment where students will act as the consultants |
| Transforming views and inspiring change | <ul style="list-style-type: none">▪ Students will have to explore and submit their viewpoint for the weekly topics in the form of a Journal;▪ Longer essays on their choice of some of the weekly topics |
| Encouraging reflective thinking | <ul style="list-style-type: none">▪ Discussion forum for peer discussion; Journal entries for self-reflection |

¹ For more details on the contents of papers, the difference between academic papers and business reports, how to read a paper, how to reference and other topics on Research Methods, students can refer to the lecturer's website page <https://sites.google.com/site/roulainglesilotzphd/lectures>

| | |
|---|--|
| Providing appropriate learning support | <ul style="list-style-type: none"> ▪ Discussion forum specifically for submission of questions to lecturer with regards to content and administrative issues |
| Respecting diversity | <ul style="list-style-type: none"> ▪ Online survey on the first day of class to capture characteristics of the students and let them know each other; |
| Providing appropriate learning support | <ul style="list-style-type: none"> ▪ Different formats of conveying knowledge to accommodate student's learning preference: Pre-lecture readings, Face-to-face presentation, In-class discussion of the topic, Provision of presentation material in pdf formats for revision |

4.2 Assessment structure

The module carries a weight of 10 credits.

| Type | Description (Deadline) | % of Final Grade |
|---------------------|---|------------------|
| Graded Discussion | <ul style="list-style-type: none"> ▪ Online discussions (through ClickUP) that will be organised in forums depending on the weekly topic. Students will be graded on their participation and quality of their posts. ▪ Each week a different student will have to start a discussion based on the topic dealt with in class. ▪ The “three-sentence” rule will be followed. The first sentence will have to denote an agreement or not with the previous post, followed by a sentence containing the student's own opinion on the topic; concluding with a sentence where the student demonstrates more depth in his/her argument. (One week from each lecture) | 10% |
| Graded Journal | <ul style="list-style-type: none"> ▪ A journal is a personal writing space for self-reflection. ▪ The content is only available to the student (author) and the lecturer. ▪ A minimum of 10 posts are expected and the lecturer will grade both the quality and number of entries. Journal posts should not be longer than 100 words and they should be the students' reflection on the topic of the week. (One week from each lecture) | 10% |
| Practical exercises | <ul style="list-style-type: none"> ▪ During the semester, four practical exercises will have to be submitted. ▪ More information and deadlines will be announced in due time. ▪ The exercises will evaluate the students' understanding on the following topics: <ul style="list-style-type: none"> a) Decomposition techniques | 15% |

| | | |
|------------|---|------|
| | <ul style="list-style-type: none"> b) Energy balances c) Emission Inventories d) System dynamics <ul style="list-style-type: none"> ▪ Deadlines and more information will be given during the course in ClickUP | |
| Assignment | <ul style="list-style-type: none"> ▪ Students will have to choose a country and write two reports, to demonstrate their understanding of concepts and topics as well as their appropriate argumentation: <ul style="list-style-type: none"> a) Energy and Environmental profile. b) Climate change policy and strategy. ▪ Deadlines and more information will be given during the course in ClickUP. | 20% |
| Role play | <ul style="list-style-type: none"> ▪ Students will have to participate in a role playing exercise, where they will have to present their opinions (according to the role assigned to them) and interact with the rest of the group in a “meeting”. | 15% |
| Exam | <ul style="list-style-type: none"> ▪ A written exam at the end of the semester will be covering all topics discussed in class. (To be announced) | 30% |
| Total | | 100% |

5. Students with special needs

Kindly inform the lecturer of special needs in order to ensure effective accommodation.

6. Learning Units outline

In these section of the Study guide, I will discuss the main topics that we will see in class in each of the lectures. At the end of the discussion of each unit, you will find the proposed activities.

6.1 Brief outline

| Week | Date | Topics |
|------|--|--|
| 1 | 20/7/2017 | <p><i>Lecture 1: Introduction, basic concepts, principles and statistics</i></p> <ul style="list-style-type: none"> ▪ Introduction to the course ▪ “Knowing your class” and Expectations surveys ▪ Learning to talk in “energy and environment” language ▪ Energy statistics ▪ Energy flows |
| 2 | 27/7/2017 | <p><i>Lecture 2: Energy supply</i></p> <ul style="list-style-type: none"> ▪ Basics of energy supply ▪ Fossil fuel supply- Scarcity? ▪ Electricity supply ▪ Renewables, natural gas and nuclear? ▪ Optimal energy fuel mix |
| 3 | 03/08/2017 | <p><i>Lecture 3: Energy demand</i></p> <ul style="list-style-type: none"> ▪ Definition and Fundamentals of energy demand ▪ Consumer demand for energy: utility maximization ▪ Cost minimization problem of the producer ▪ Demand elasticities ▪ Decomposition versus Econometrics: complements or substitute methods ▪ Disaggregated sectoral demand characteristics ▪ Demand-side management |
| 4 | 10/8/2017 | <p><i>Lecture 4: Energy efficiency</i></p> <ul style="list-style-type: none"> ▪ Energy efficiency and intensity: definition, and measurement ▪ Energy efficiency improvements ▪ Rebound effect and Energy efficiency gap |
| 5 | Incorporated in the class of 10 th of August 2017 | <p><i>Lecture 5: Energy markets</i></p> <ul style="list-style-type: none"> ▪ Pricing exhaustible resources ▪ Competition vs monopoly in energy markets ▪ Market failures: rent and externalities ▪ Economic regulation ▪ Energy taxation ▪ Oil: an international market ▪ Electricity market liberalization |
| 6 | 24/8/2017 | <p><i>Lecture 6: System dynamics</i></p> <ul style="list-style-type: none"> ▪ Introduction to System thinking and System Dynamics ▪ System dynamics tool ▪ When to use system dynamics- Application ▪ System dynamics modelling process ▪ Causal loop diagrams and Feedback loops ▪ Introduction to Vensim |

| | | |
|-----------|------------------|---|
| 7 | 31/8/2017 | <i>No class (ESSA Conference)</i> |
| 8 | 7/9/2017 | <p><i>Lecture 7: Energy and the Environment</i></p> <ul style="list-style-type: none"> ▪ Environmental Kuznets curve ▪ Environment protection ▪ Pollution control ▪ Greenhouse gas emissions: sources, trends, scenarios ▪ Abatement costs of emissions reductions |
| 9 | 14/9/2017 JNB | <p><i>Lecture 8: Natural resources and externalities</i></p> <ul style="list-style-type: none"> ▪ Sustainability and scarcity ▪ Basic Hotelling model /Hotelling rule /Hotelling- refinements ▪ Taxation and leasing of exhaustible resources ▪ Externalities ▪ Green paradox ▪ Common pool resources ▪ Property rights ▪ Biodiversity and species preservation |
| 10 | 21/9/2017 | <p><i>Lecture 9: Climate change</i></p> <ul style="list-style-type: none"> ▪ Processes and projections ▪ Economic impacts ▪ Marginal economic impacts ▪ Discounting, equity, uncertainty ▪ Impacts and valuation ▪ Valuation methods ▪ Social cost of carbon ▪ How to solve the climate change problem |
| 11 | 28/9/2017 | <p><i>Lecture 10: Energy and economic development</i></p> <ul style="list-style-type: none"> ▪ Indicators of energy poverty ▪ Energy poverty vs environmental protection? ▪ Energy access rates ▪ Renewable energies and the poor ▪ Energy ladder ▪ Natural disasters ▪ Poverty traps |
| 12 | 5/10/2017 | <i>No class - Recess</i> |
| 13 | 12/10/2017 | <p><i>Lecture 11: Policies, instruments and technologies</i></p> <ul style="list-style-type: none"> ▪ Direct regulation ▪ Market based instruments ▪ Carbon taxes ▪ Trading policies examples ▪ Technological advances over the years ▪ Adaptation policies ▪ Clean Development Mechanism ▪ International Environmental and Climate change agreements |
| 14 | 19/10/2017 | Role play exercise |

| | | |
|----|------------|---|
| 15 | 26/10/2017 | Lecture 12: South Africa and World energy outlook <ul style="list-style-type: none"> • Feedback session of the role play exercise • South Africa: Demand and supply issues • South Africa: Environmental commitments and policies • Guidelines on comparative studies and energy report writing |
|----|------------|---|

6.2 Suggested readings

Energy and environmental economics is a rapidly evolving field with interesting and important articles being published frequently. For this reason, no textbook is prescribed for this module. Suggested readings will be posted in clickUP at least a week before each lecture. It should be noted that these lists are not exhaustive but indicative. Please check regularly. Also if students find something interesting on the topic they are encouraged to share with the lecturer and the rest of the group.

Only, two books with the fundamentals of energy and environmental economics are suggested here, to be used as general references:

Bhattacharyya, S.C. (2011). *Energy Economics: Concepts, Issues, Markets and Governance*. London, UK: Springer.

Tol, R.S.J. (2014). *Climate Economics: Economic analysis of climate, climate change and climate policy*. Cheltenham, UK: Edward Elgar Publishing Limited.

7. Acknowledgements

This syllabus is based on several classes taught at various institutions. Its first incarnation is based on the syllabi of courses such as *Energy and Environment* by Prof Gernot Wagner at the New York University Stern Business School of Business, *Natural Resource and Energy Economics* by Profs Hunt Allcott and Charles Kolstad at the Stanford University, *Economics of Energy and the Environment* by Prof Richard Sweeney at the Harvard University, and *International Political Economy of the Environment* by Dr Robert Falkner at the London School of Economics, *Environmental and Energy Economics* by Prof Erin Mansur at the Dartmouth

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